Fig1

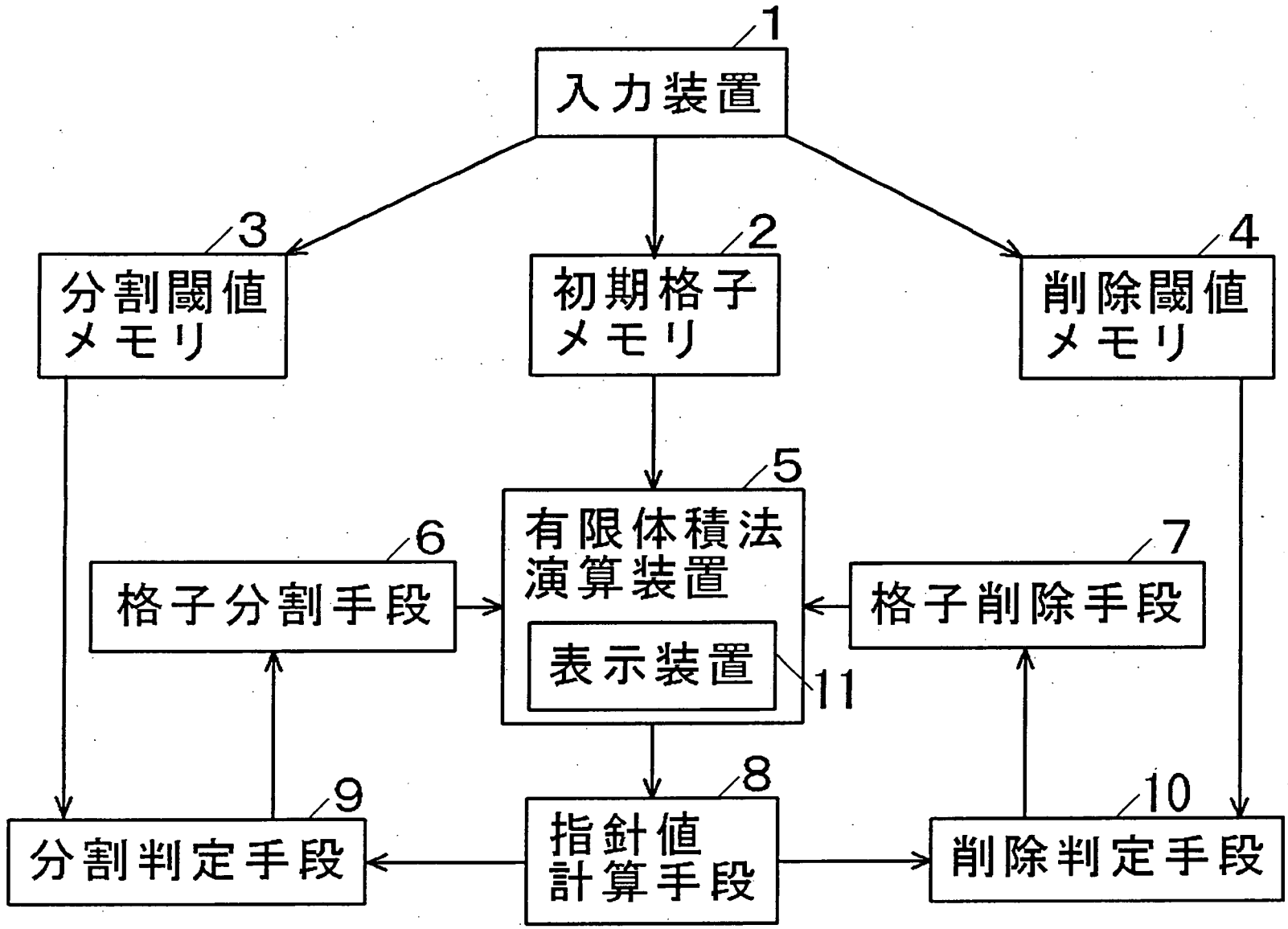

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Fig2

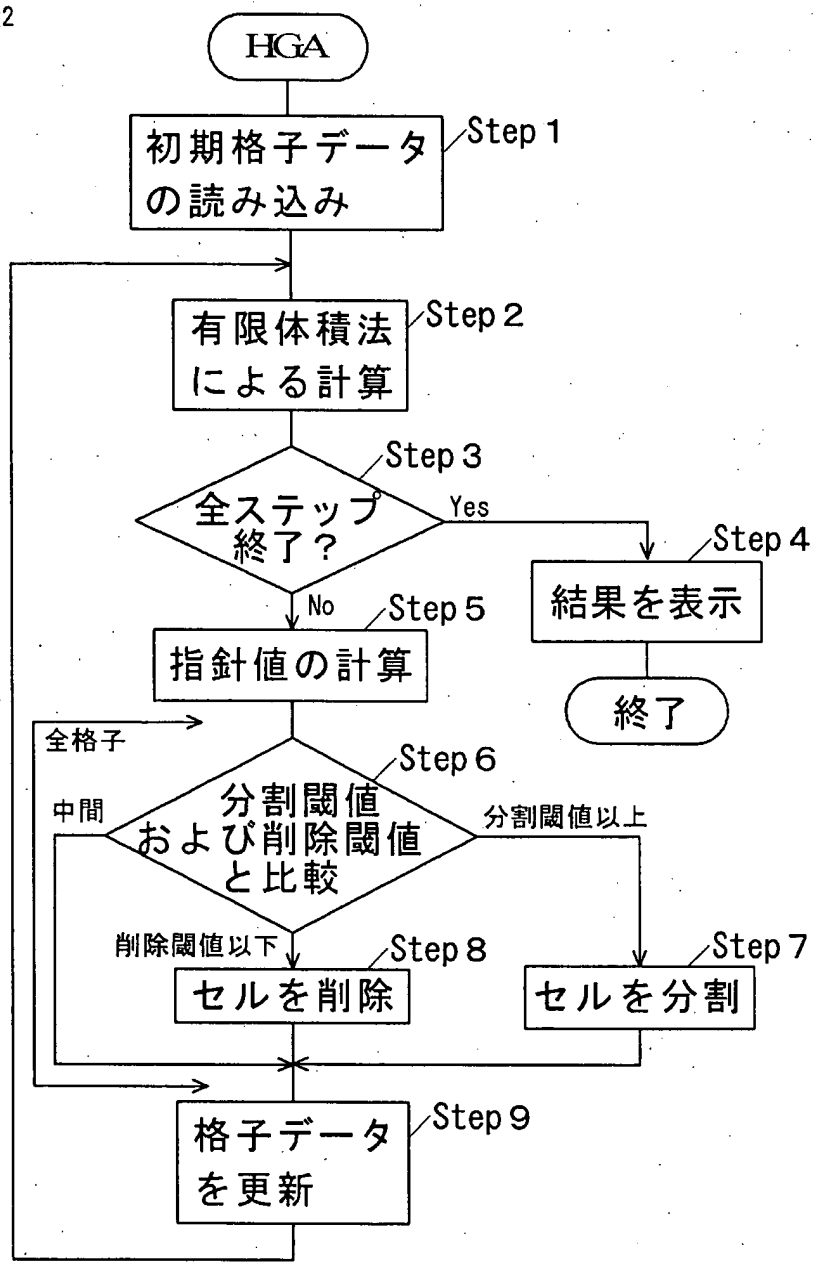
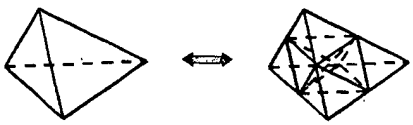
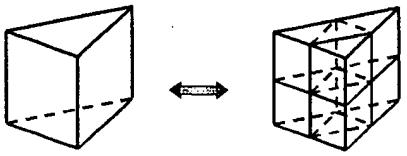

HGA
初期格子データの読み込み
Step 1
有限体積法による計算
Step 2
Step 3
全ステップ終了？
Yes
Step 4
結果を表示
終了
No
Step 5
指針値の計算
全格子
Step 6
分割閾値および削除閾値と比較
中間
分割閾値以上
削除閾値以下
Step 8
セルを削除
Step 7
セルを分割
格子データを更新
Step 9

Fig3

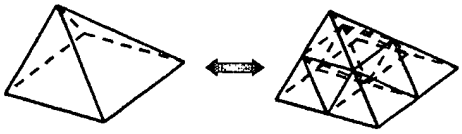


（ａ）四面体の８分割法

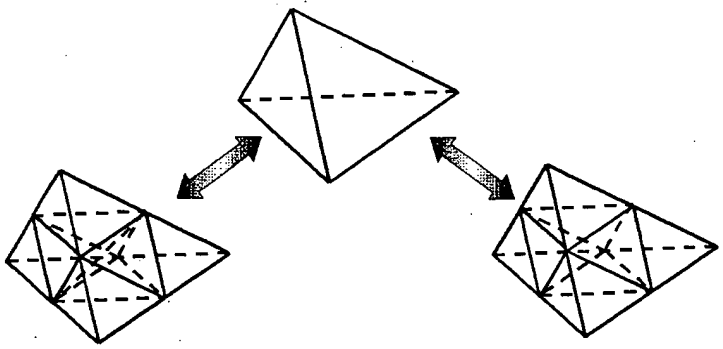
（ｂ）六面体の８分割法



（ｃ）三角柱の８分割法



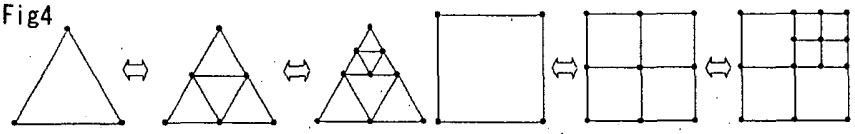
（ｄ）四角錐の10分割法



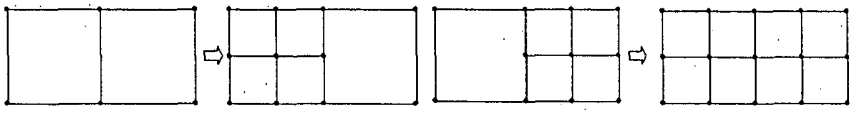
	Level 0	Level 1	Level 2	Level 3	Level 4
Tetrahedron:8	1	8	64	512	4096
Tetrahedron:4 Pyramid:2	1	6	44	328	2448

（ｅ）四面体の６分割法

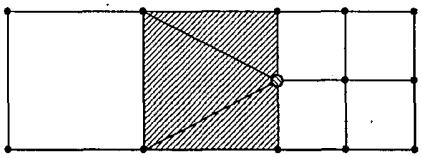
Fig4



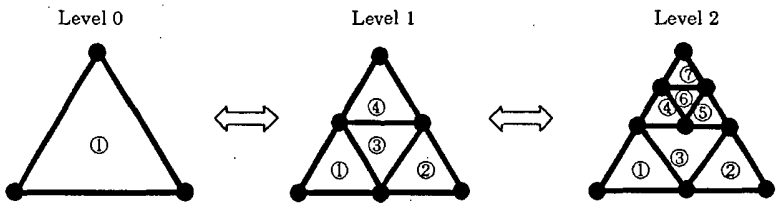
（ａ）三角形の分割削除　　（ｂ）四角形の分割削除



（ｃ）レベル差０の格子を分割(四角形セル)　（ｄ）レベル差１の格子を分割(四角形セル)



（ｅ）遷移格子



cp[1]->parent[0] = ①	cp[1]->parent[1] = ①	cp[4]->parent[2] = ④
cp[1]->brother[0] = 0	cp[1]->brother[1] = ②	cp[4]->brother[2] = ⑤
	cp[2]->parent[1] = ①	cp[5]->parent[2] = ④
	cp[2]-> brother[1] = ③	cp[5]->brother[2] = ⑥
	cp[3]->parent[1] = ①	cp[6]->parent[2] = ④
	cp[3]-> brother[1] = ④	cp[6]->brother[2] = ⑦
	cp[4]->parent[1] = ①	cp[7]->parent[2] = ④
	cp[4]-> brother[1] = ①	cp[7]->brother[2] = ④

（ｆ）家族関係

Fig5

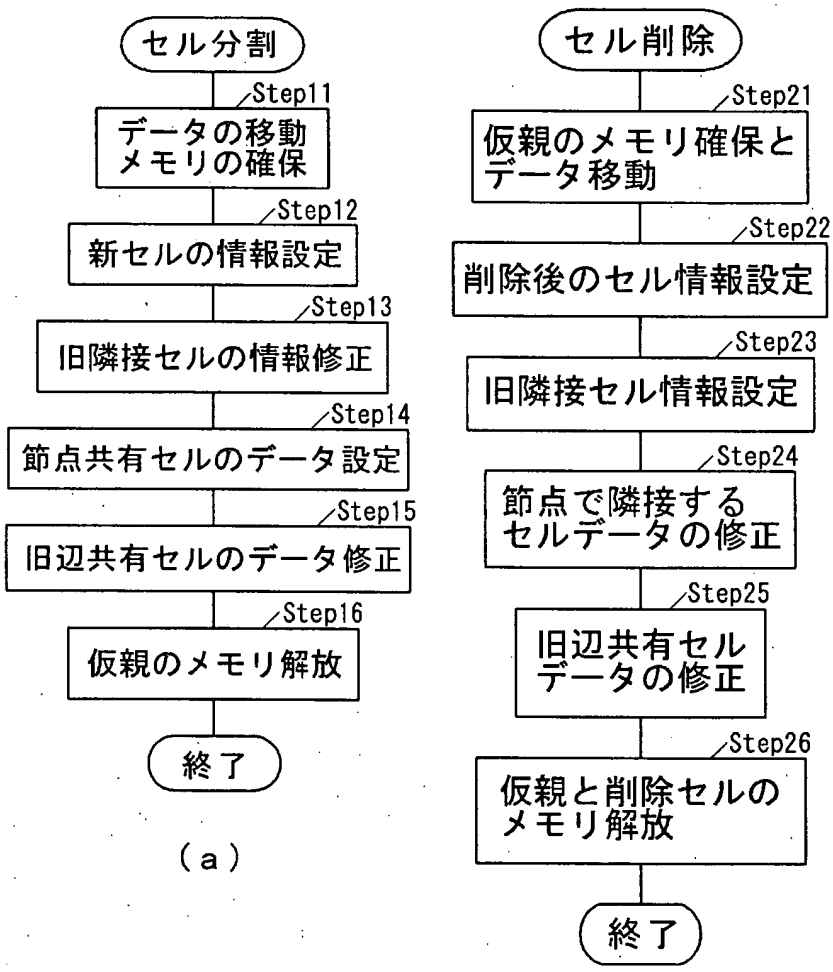
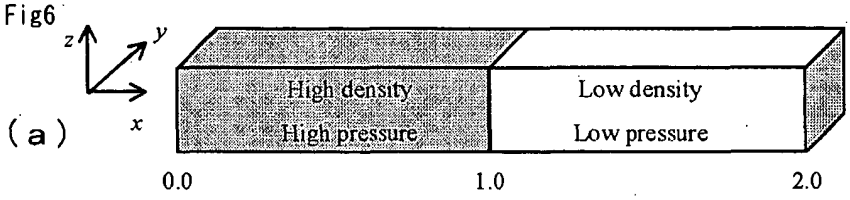
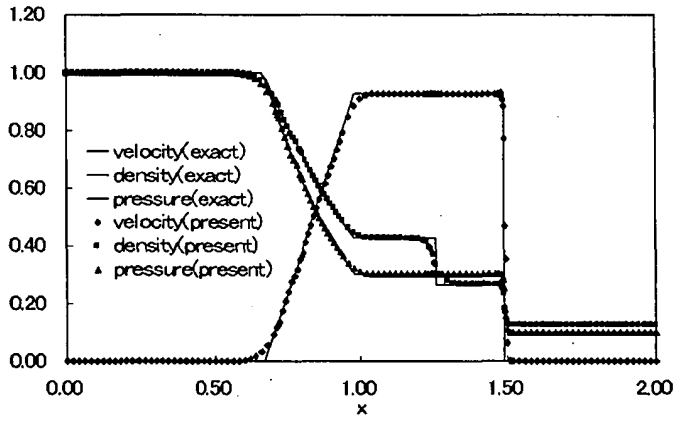

セル分割
Step11
データの移動
メモリの確保
Step12
新セルの情報設定
Step13
旧隣接セルの情報修正
Step14
節点共有セルのデータ設定
Step15
旧辺共有セルのデータ修正
Step16
仮親のメモリ解放
終了
（ａ）
セル削除
Step21
仮親のメモリ確保と
データ移動
Step22
削除後のセル情報設定
Step23
旧隣接セル情報設定
Step24
節点で隣接する
セルデータの修正
Step25
旧辺共有セル
データの修正
Step26
仮親と削除セルの
メモリ解放
終了
（ｂ）

Fig6

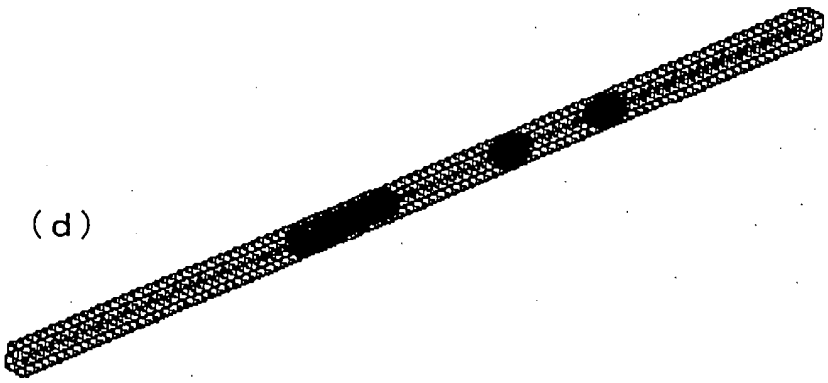

z
y
x
High density
High pressure
Low density
Low pressure
0.0
1.0
2.0

(a)

(b)

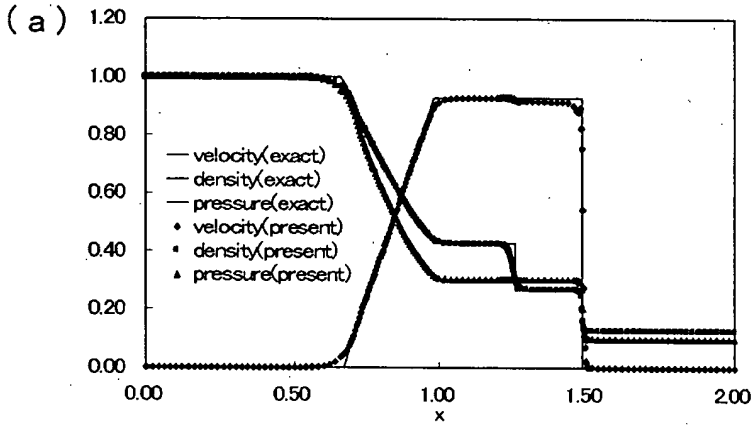

1.20
1.00
0.80
0.60
0.40
0.20
0.00
velocity(exact)
density(exact)
pressure(exact)
velocity(present)
density(present)
pressure(present)
0.00
0.50
1.00
1.50
2.00
x

(c)

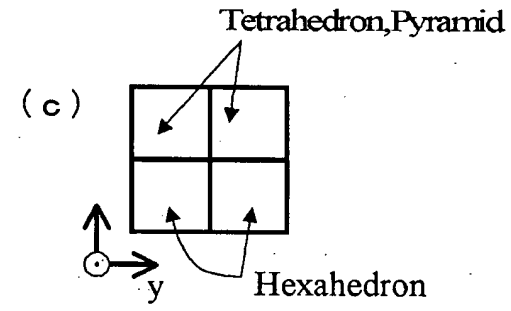


(d)

Fig7


(a)
1.20
1.00
0.80
0.60
0.40
0.20
0.00
velocity(exact)
density(exact)
pressure(exact)
velocity(present)
density(present)
pressure(present)
0.00
0.50
1.00
1.50
2.00
x

(b)


Tetrahedron,Pyramid
(c)
y
Hexahedron

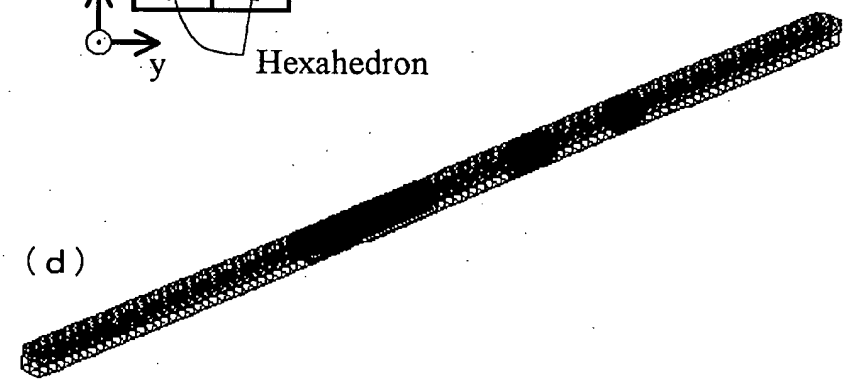
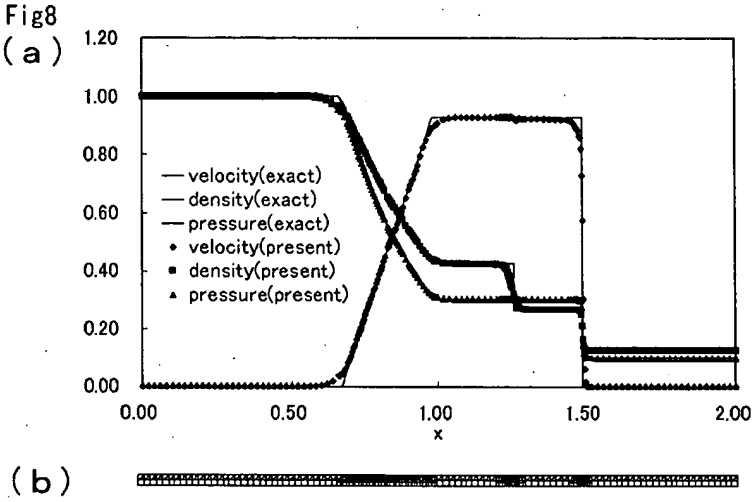

(d)

Fig8


(a)
1.20
1.00
0.80
0.60
0.40
0.20
0.00
velocity(exact)
density(exact)
pressure(exact)
velocity(present)
density(present)
pressure(present)
0.00
0.50
1.00
1.50
2.00
x
(b)

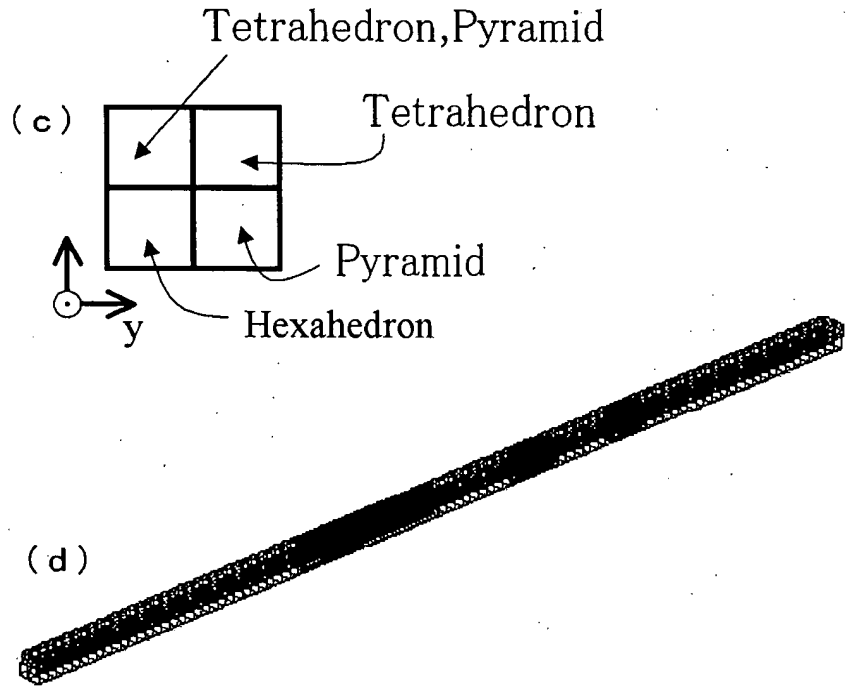
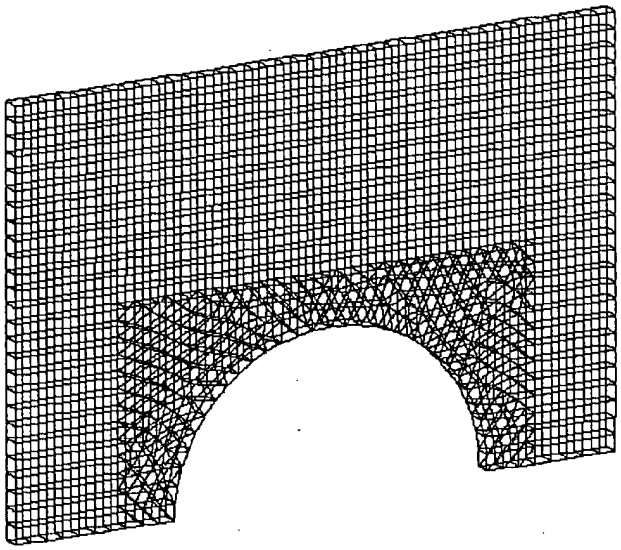

Tetrahedron,Pyramid
(c)
Tetrahedron
Pyramid
y
Hexahedron
(d)

Fig9

(a)



(b)

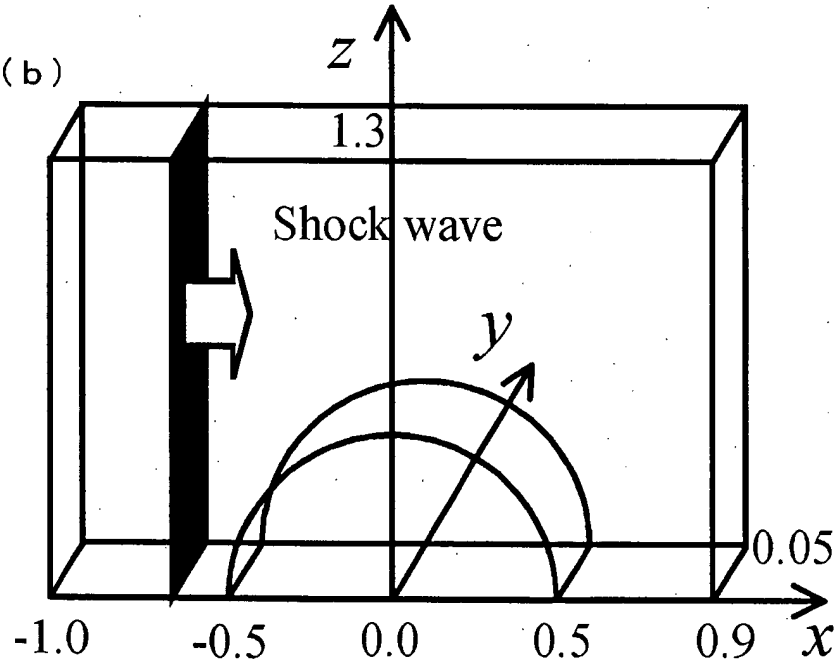
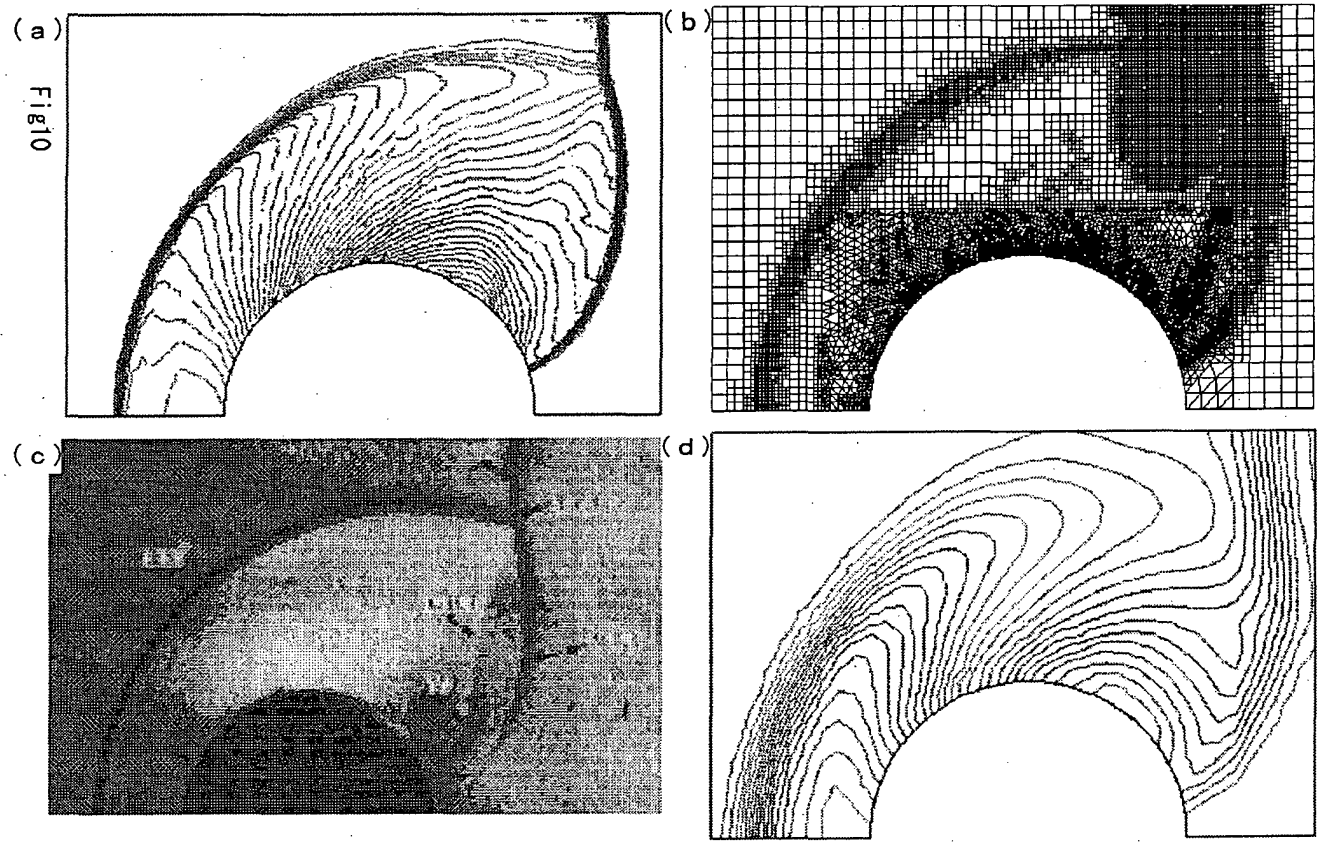
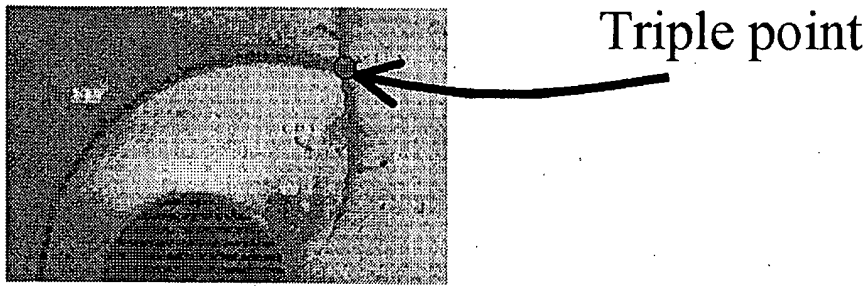
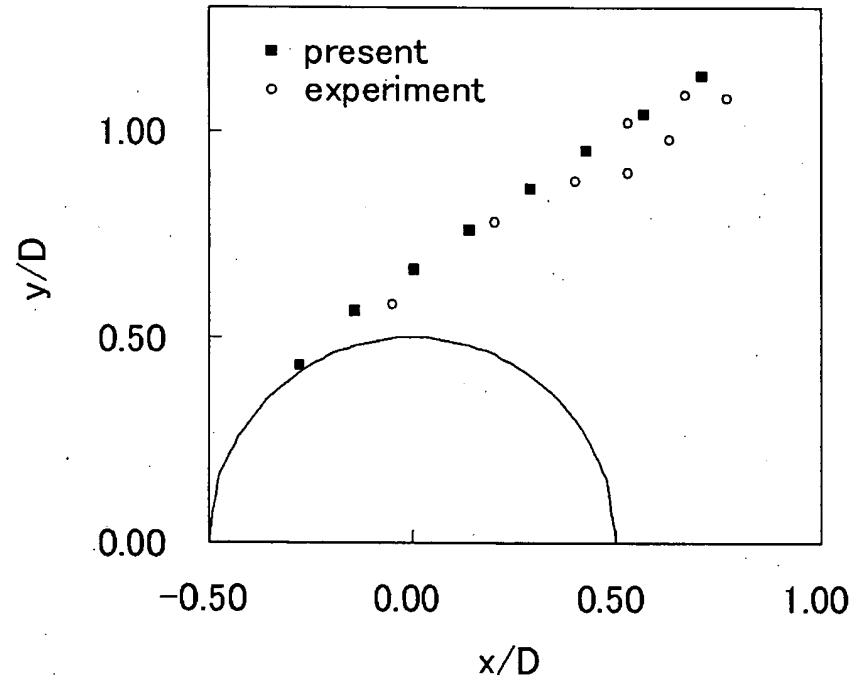


Fig10




Triple point

(a)

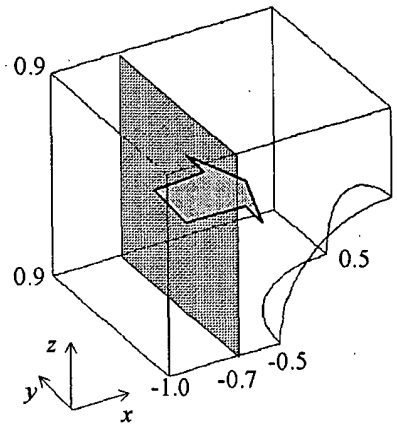

present
experiment
1.00
0.50
0.00
y/D
-0.50
0.00
0.50
1.00
x/D

(b)

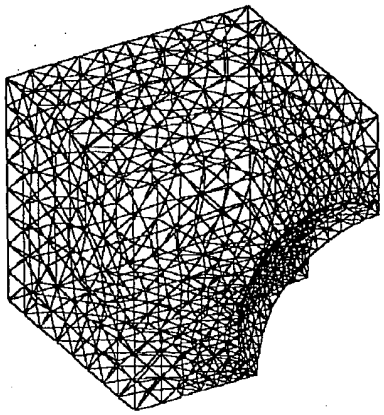
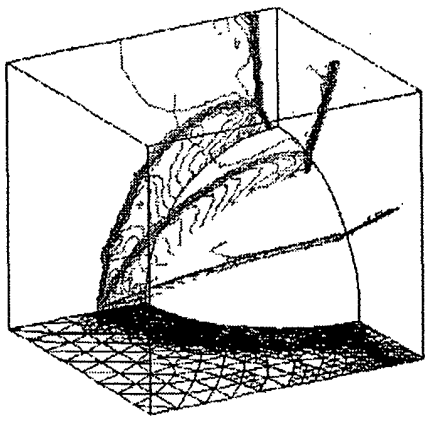
Fig11

Fig12

(a)



(b)



(c)